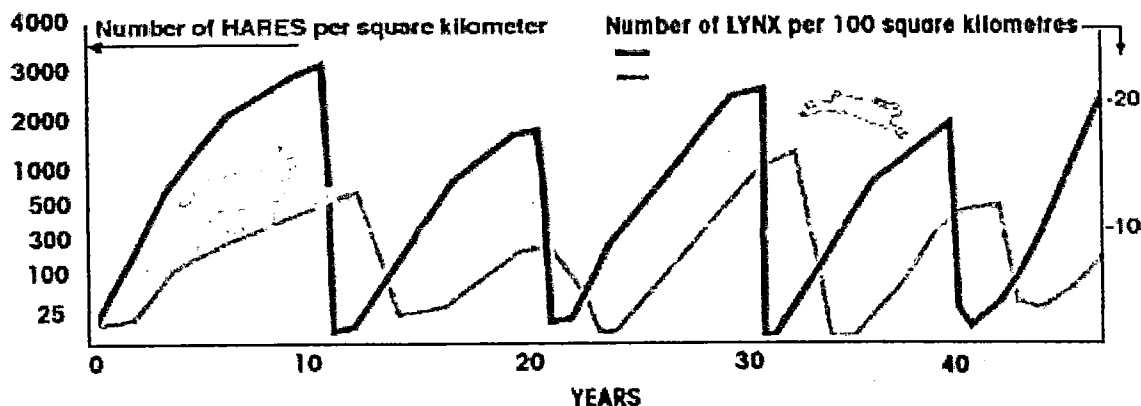


Lynx-Hare Cycles

Look at the graph. It illustrates the relationship between the size of the hare population and the size of the lynx population. Notice how each population has a boom (when there are too many lynxes or hares for the available resources) and a bust (when many hares or lynxes die and very few are left) pattern. Look at the pattern in the graph. Notice how the lynxes' pattern closely follows the hares' pattern, but that the lynxes' peaks and valleys happen a bit after the hares' peaks and valleys. Why do you think the lynx population so closely follows the hare population?



What is happening is complex. The lynx and hare populations have a predator-prey relationship. Disease, food supply and other predators are variables in this complex relationship. The flux in this cyclic relationship is what allows for the ecosystem dynamic to work. Without flux, vegetation wouldn't have a chance to recover from the hare population's continuous eating, and without vegetation, the hare population could no longer exist in its habitat, and therefore neither could the lynx population that depends upon the hare population for food.

Every ten years or so, the hares' reproduction rate increases. As more hares are born, they eat more of their food supply. They eat so much food that they are forced to supplement their diet with less desirable and nutritious food. As the hare population size grows, the lynx population size begins to increase in response. Because there are so many hares, other predators opportunistically begin to hunt them along with the lynxes. The hares' less nutritious and varied diet begins to have an effect, the hares begin to die due to illness and disease. Fewer hares are born because there is less food. The hare population size begins to go into a steep decline. Therefore, the lynx population also begins to decline. Some lynxes starve and others die due to disease. Both the lynx and hare populations have fewer babies and this decrease in population gives the vegetation a chance to recover. Once there is enough vegetation for the hares to begin to increase their population the whole cycle begins again.

Graph taken from the following website: http://www3.gov.ab.ca/srd/fw/watch/rabb_cycles.html 9/30/02
 Courtesy of Alberta Sustainable Resource Development
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Parachuting Cats Into Borneo³

In the early 1950s, there was an outbreak of a serious disease called malaria amongst the Dayak people in Borneo. The World Health Organization tried to solve the problem. They sprayed large amounts of a chemical called DDT to kill the mosquitoes that carried the malaria. The mosquitoes died and there was less malaria. That was good. However, there were side effects. One of the first effects was that the roofs of people's houses began to fall down on their heads. It turned out that the DDT was also killing a parasitic wasp that ate thatch-eating caterpillars. Without the wasps to eat them, there were more and more thatch-eating caterpillars. Worse than that, the insects that died from being poisoned by DDT were eaten by gecko lizards, which were then eaten by cats. The cats started to die, the rats flourished, and the people were threatened by outbreaks of two new serious diseases carried by the rats, sylvatic plague and typhus. To cope with these problems, which it had itself created, the World Health Organization had to parachute live cats into Borneo.

The Lemmings of Norway: An Example of Balancing Populations by Flux

Lemmings are tiny rodents that live in the Arctic regions. Lemmings are what scientists call a “key species.” That means that a lot of what goes on in the lemmings’ ecosystem is linked to the size of their population. Animals like snowy owls and arctic foxes depend on lemmings for food, and how many babies they have depend on how many lemmings there are to eat.

Lemmings keep the ecosystem balanced through flux. Every three to four years, the numbers of the lemming population go through a cycle. During one part of the cycle, there are almost no lemmings anywhere. They have all died from starvation or been eaten.

One lemming can have as many as eleven babies, so even if there are only a few lemmings, their population size will grow. Over the next three years the size of the lemming population grows very quickly, and becomes enormous. After a female lemming is one month old, she can give birth to her first litter. So can all of her sisters and cousins. Can you imagine how many babies could be born after only one month? After a few years, there are so many lemmings that they begin to fight. They fight for space, and vegetation – their main food source. Eventually there are so many of them that there isn’t enough food. Some starve to death, and some get eaten, but one species of lemmings in Norway just picks up and leaves. In a mass migration (moving from one home to another all at the same time) they leave, eating everything in their path. They swim across rivers to get to the other side and simply continue on. When they get to the ocean, it just looks like a very big river to them, so they start swimming. In fact, some lemmings have even been seen out in the ocean on floating ice. If you find Norway on a map, you’ll see that the nearest landmass off the coast of Norway is very far away. One tiny little lemming can’t swim that far, and many of them drown.

ECOLOGICAL RELATIONSHIPS

The following situations illustrate various ecological relationships. Identify which relationship (commensalisms, mutualism, parasitism, or predation) is described in each situation.

1. A mite (an eight-legged organism similar to a spider) lives in the base of the eyelashes of people who use mascara. It feeds on the mascara; it does not seem to harm people.
2. A coyote captures, kills, and eats a rabbit.
3. A tapeworm lives in the intestines of a dog. It absorbs food the dog has eaten and grows larger in the process. The dog becomes weaker from malnutrition.
4. Birds eat insects that the hooves and muzzles of grazing cows disturb.
5. The flower of the yucca plant provides the only location where the yucca moth can lay her eggs. In the process, the moth pollinates the yucca flower.
6. Cleaner shrimp living in the ocean eat ectoparasites (parasites on the outer surface of the animal) off fish.
7. Bacteria that live on the surface of our teeth require sugar from our food to survive. A by-product of their metabolism (body processes) decays the enamel of teeth.
8. A 3-point buck is killed by a hunter.
9. Bacteria in the intestines of cows produce vitamin C, enabling cows to skip orange juice at breakfast.

Name: _____ Class: _____ Date _____

Readings Follow UP

1. After reading the Lynx Hare cycles, identify what changes are taking place in the populations?
2. What are some abiotic factors are affecting both populations?
3. How does Population increase affect limiting and carrying capacities? What is the impact on the overall well being of the populations?
4. After reading Parachuting cats into Borneo, identify what the ecological impact of DDT was on that area.
5. What populations were impacted and how?
6. What do you think the impact of The World Health's Organization would be? Do you think it was a reasonable solution to the identified problem?

7. After reading the Lemmings story, identify the reason why they are called a key species.
8. What is the reproductive potential for Lemmings and what impact does that have on the ecosystem?
9. How do some of the Lemmings, improve and resolve carrying and limiting capacity issue that result? Provide reasoning to support your answer?